Tanta university
Faculty of engineering
Electrical power and machines department

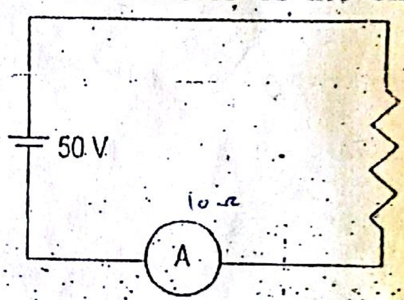
Electric Measurements
First year
2008/2009

Sheet No (1)

1. A voltammeter reads 127.5 V and the true value of the voltage is 127.13. Determine: i. static error. ii. static correction.

2. A voltage has a true value of 150V . An analogue instrument with a scale range of zero to 250V shows a voltage of 146V. Determine :
   i. Absolute error and correction.
   ii. Percentage error as a fraction of true value.
   iii. Percentage error as a fraction of full scale deflection.

3. It is desired to measure the value of current in 500Ω resistor of the circuit shown by connecting 10Ω ammeter. Find:
   i. The actual value of current.
   ii. The measured value of current
   iii. The percentage error in measurement.
   iv. Repeat the above requirements if another ammeter having resistance of 3Ω.



4. A 0-150 V voltammeter has a guaranteed limiting error of 1% of the full scale reading. The measured voltage is 75 V. calculate the limiting error in percent at this reading.

5. A 4-dial decade box has :
   Decade of 10 x 1000 Ω ± 0.1 %.
   Decade of 10 x 100 Ω ± 0.1 %.
   Decade of 10 x 10 Ω ± 0.5 %.
   Decade of 10 x 1 Ω ± 1 %.
   It is set at 4639 Ω. Find the percentage error and the range of resistance value.

6. A moving coil voltammeter has a uniform scale with 100 divisions the full scale reading is 200V and 1/10 0f a scale division can be estimated with a fair degree of certainty. Determine the resolution of the instrument in volt.

7. A digital voltammeter has a read-out range from 0 to 9999 counts. Determine the resolution of the instrument in volt when the full scale reading is 9.999 V.

$$\text{resolution} = \left(\frac{\text{read out Range}}{\text{Full scale}}\right)^{-1} = \frac{\text{Full scale}}{\text{read out Range}}$$

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Sheet No. [1]

[1] :-

$A_m = 127.5 V$ $A_t = 127.13 V$

Determine:-

i] static error.

ii] static correction.

→ [Solution] ←

$\delta_o = A_m - A_t = 127.5 - 127.13 = +0.37 V$

∴ Static error = +0.37 V

∴ Correction = $-\delta_o$ = -0.37 V

[2] :-

$A_t = 150 V$ scale (0 → 250 V)

$A_m = 146 V$

Determine:-

i] Absolute error and correction.

ii] Percentage error as fraction of true value.

iii] percentage error as fraction of Full scale deflection.

→ [Solution] ←

i] absolute error = $A_m - A_t = 146 - 150 = -4$ volt

ii] Static corriction = $-\delta_o = +4$ volt.

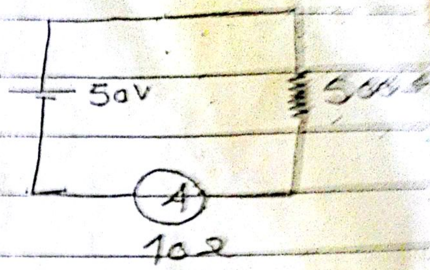
iii] Percentage error = $\frac{A_m - A_t}{A_t} \times 100 = \frac{\delta_o}{A_t} \times 100$

$= \frac{-4}{150} \times 100 = -2.667\%$

Percentage error as Fraction of full scale

$\frac{\delta A}{250} \times 100 = \frac{-4}{250} \times 100 = -1.6\%$

[3]



$R = 500\ \Omega$, $R_{int} = 10\ \Omega$

[illegible]

Actual = true

i] The actual value of current.
ii] The measured value of current
iii] The percentage error in measurement
iv] Repeat with another ameter having resistance of 3Ω.

→ [Solution] ←

i] $A_t = I_t = \frac{50}{500} = 0.1\ A$ ← بدون تأثير الأميتر

ii] $A_m = I_m = \frac{50}{500+10} = 0.098\ A$ ← في وجود الأميتر

iii] $\%\delta r = \frac{A_m - A_t}{A_t} = \frac{0.098 - 0.1}{0.1} \times 100 = -2\%$

with another ameter: has 3Ω resistance

i] $A_t = I_t = \frac{50}{500} = 0.1\ A$

ii] $I_m = \frac{50}{500+3} = 0.0994\ A$

iii] $\%\delta r = \frac{A_m - A_t}{A_t} = \frac{0.0994 - 0.1}{0.1} \times 100 = -0.6$

ال error قل أكثر

[illegible]

[8]

$\frac{m - t}{fu}$

4

A (0 → 150 V) voltmeter limiting error 1% full scale

Am = 75 V

Determine:- limiting error in Percent at this reading.

→ [Solution] ←

$0.01 = \frac{A_m - A_t}{Full\ s.} = \frac{75 - A_t}{150} \rightarrow A_t = 76.5$

maximum error = $150 * \frac{1}{100} = 1.5$

% error at (75 V) = $\frac{1.5}{75} * 100 = 2\% = \frac{A_m - A_t}{A_t}$

5

A 4-dial decade box has:

Decade of 10 * 1000 Ω ± 0.1% → آلاف

// // 10 * 100 Ω ± 0.1% → مئات

// // 10 * 10 Ω ± 0.5 % عشرات

// // 10 * 1 Ω ± 1 % آحاد

it is set at 4639 Ω. find the Percentage error and range of resistance value.

→ [Solution] ←

4	6	3	9
4000	600	30	9
آلاف	مئات	عشرات	آحاد

error (δ_0) = $4000 * \frac{0.1}{100} + 600 * \frac{0.1}{100} + 30 \times \frac{0.5}{100} + 9 * \frac{1}{100} = 4.84\ \Omega$

Range of resistance from (4639 - 4.84) to (4639 + 4.84)

(4634.16) to (4643.84) Ω

[1] Percentage error $= \delta r \% = \frac{50}{4639} \times 100 =$

$$\frac{4.84}{4639} \times 100 = 0.1043\%$$

[6] voltmeter with unifor scall 100 divisions full scale reading is 200 V and 1/10 of a scale devision can be estimated. Determine the resolution of instrument in volt.

[Solution] ←

resolution $= \frac{200}{100} \times \frac{1}{10} = 0.2$ volt

[7]

resolution $= \frac{9.999}{9999} = 0.001$ V

⇐ ملحوظة : ال resolution تكون رقم صغير